

Visibility-reducing organic aerosols in the vicinity of Grand Canyon National Park:

2. Molecular composition

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In this study we examine the molecular organic constituents (C8 to C40 lipid compounds) collected as aerosol from two sites located in Grand Canyon National Park during summer ambient conditions. Of special interest are molecular species which serve as tracers for possible sources of the observed aerosol organic matter. Ambient samples were collected from Hopi Point (rim site) and from Indian Gardens (in-canyon site) as fine ($dp < 2.1 \mu m$) and total particle samples. The samples were grouped into fine particle and total particle monthly composites to provide sufficient material for molecular marker analysis, then analyzed by capillary gas chromatography/mass spectrometry (GC/MS). The molecular constituents of each aerosol composite were screened for key tracer compounds using a computerized data reduction method that was based on molecular ion fragment identification. Comparisons were made to a reference database that included molecular information obtained from authentic sources of primary organic aerosol emissions. Emission sources studied included vehicular exhaust, as well as local sources at the Grand Canyon which included soil dust, wood smoke, and particles from vegetation indigenous to the two Grand Canyon sampling sites. Our results show that summertime ambient aerosols contain many organic molecular compounds which can be related directly to the local vegetation. Another major component found in all samples consists of highly oxidized organic species which are not emitted directly from local primary organic aerosol source types. These oxidized species are thought to be secondary organic aerosols that originate from photochemical transformations involving either locally emitted primary organic compounds or transported aged emissions from source regions upwind of the Grand Canyon.